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SURVEY MONUMENTATION STUDY

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DSC-1382-2
Sept. 1971

38047703

To: Director, DSC

From: Richard B. Case, D-441

Subject: Field Trip Report

Covering Travel To:	Dates:
Salt Lake City, Utah and Redding, California	June 15-24, 1983

PLEASE number paragraphs in accordance with subjects listed below; if one or more items is not applicable, so state.

1. Purpose/Objectives of Trip
2. Persons Contacted/Interviewed
3. Subjects Discussed
4. Facts Gathered
5. Other Observations Made
6. Accomplishments or Results of the Trip

1. Purpose of Trip:

To inspect and report on survey monuments that had been set in prescribed burn areas near Redding, California. (See Part I.)

To establish a new monumentation test bed in acid-type soils. (See Part II.)

To inspect and report on conditions of survey monuments located at Utah Test Sites No. 1A and No. 2 (alkali soils). (See Part III.)

2. Persons Contacted:

John Ferguson (Ret.), National Forest Service
Claude Hamon, BLM, California State Office
Glen Hatch, BLM, Utah State Office
John Hohol, Berntsen Cast Products
Robert Hofland, Hofland Products, Portland, Oregon
Richard Feldman, Allied Survey Products
Ken Lanspa, National Forest Service, Redding District, California
Bill Rametes, National Forest Services, Redding District, California
John Brewer, Equipment Cache, Denver Service Center

I want to especially thank Mr. Brewer for setting this trip up and making arrangements for getting all tools and test monuments to each site location in a timely and efficient manner.

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3. Subjects Discussed:

a. Monument endurance in a typical fire.
b. Effects of fire on different types of monument materials.
c. How strong acid soils may affect different monument materials.
d. Condition of monuments in alkali test beds.
e. New materials for monuments.

Use additional pages, if necessary
cc: Chief, Division/Branch of

Richard B. Case July 12, 1983
Traveler Date

GPO 855-225

4/5. Facts Gathered/Observations Made:

See Parts I, II, and III enclosed.

c.c.: B. Hostrop, WO
J. Brewer, DSC
C. Hamon, California SO
S. Robinson, California SO
J. Jelley, Alaska SO
F. Ikebush, Alaska SO
K. Witt, Colorado SO
G. Hatch, Utah SO
J. Ives, DSC
G. Speight, New Mexico SO

PART I

Post-Inspection of Cadastral Survey Monuments that had been Set in a Prescribed Burn Area Near Redding, California

June 16, 1983

Prescribed Burn Site No. 2

Location: Shasta Trinity National Forest
NE 1/4 of Section 14, Township 37N,
Range 1E, Mt. Diablo Meridian, California

Fuel Type: Mixed Conifer Logging Slash

Personnel Present:

John Brewer
Claude Hammon
John Hohol
Bob Hofland
Dick Case

Type Monuments Set: All set June 9, 1982

No. 1 - Standard Aluminum Post, 6063, Schedule 10
No. 2 - Polyvinyl Chloride, PVC, Yellow (SE), Schedule 10
No. 3 - Polyvinyl Chloride, PVC, White (SE), Schedule 80
No. 4 - Galvanized Iron Post
No. 5 - Fiberglass, Schedule 10
No. 6 - Anodized Aluminum Post
No. 7 - Aluminum Rod, 3/4", 6063-T6
No. 8 - Carsonite Rod, 5/8"
No. 9 - Stainless Steel Rod, 5/8", Type 304

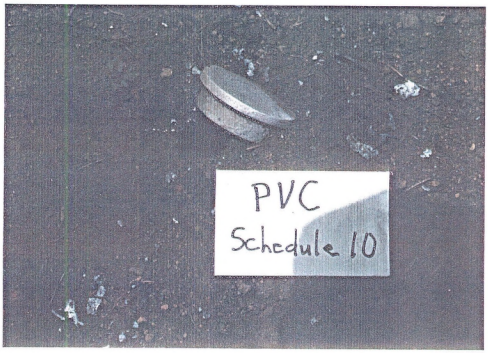
No. 1 - Standard Aluminum Post, 6063, Schedule 10

Burn Site No. 2
Set June 9, 1982
Inspection Date - June 16, 1983

This monument pipe along with its aluminum-magnesium alloy cap survived the fire in very good condition. Neither the pipe nor the cap showed evidence of melting.

No. 2 - Polyvinyl Chloride, PVC, Yellow (SE), Schedule 10

Burn Site No. 2
Set June 9, 1982
Inspection Date - June 16, 1983



There was no no evidence of this pipe above ground level. The pipe had melted in the heat and there was no evidence of the material above ground level. Below ground level the pipe was found to be in excellent condition.

The cast aluminum-magnesium alloy cap had an irregular surface with ripples indicating that a near melt condition had been reached in the heat.

No. 3 - Polyvinyl Chloride, PVC, White (SE), Schedule 80

Burn Site No. 2
Set June 9, 1982
Inspection Date - June 16, 1983

There was no evidence of this pipe above ground level. The pipe had melted in the heat and there was no evidence of the material above ground level. Below ground level the pipe was found to be in excellent condition.

The cast aluminum-magnesium alloy cap has completely melted.

No. 4 - Galvanized Iron Post (Standard Monument)

Burn Site No. 2
Set June 9, 1982
Inspection Date - June 16, 1983

This monument came through the fire in very good condition. The pipe was not damaged and the galvanizing appeared to be in very good condition.

The brass cap was not damaged by the fire. The cap was in excellent condition.

No. 5 - Fiberglass, Schedule 10

Burn Site No. 2
Set June 9, 1982
Inspection Date - June 16, 1983

This monument was severely damaged in the fire. All resin had melted away and the monument had broken at ground level. Only frayed glass fibers remained of the pipe body above ground. Below ground level the pipe was in very good condition.

The cast aluminum-magnesium alloy cap showed evidence of melting on the outer edges. The top of the cap had a checked pattern indicating that the metal had been very near a liquid state.

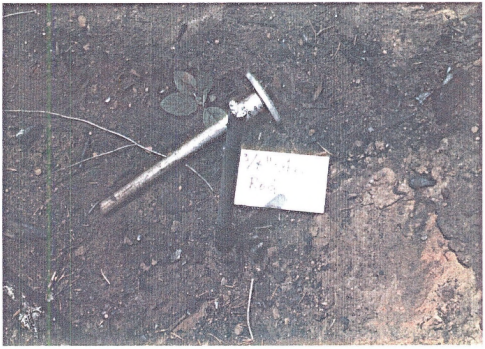
No. 6 - Anodized Aluminum Post

Burn Site No. 2
Set June 9, 1982
Inspection Date - June 16, 1983

Both the pipe body and cap of this monument came through the fire in very good condition. It should be noted that this cap was a forged aluminum cap.

No. 7 - Aluminum Rod, 3/4", 6063-T6

Burn Site No. 2
Set June 9, 1982
Inspection Date - June 16, 1983



The rod section of this monument had cracks and raised portions, indicating a near liquid state. At about 18 inches above ground level the rod had broken and the top portion of the rod and cap had fallen to the ground. The forged aluminum cap was in good condition.

No. 8 - Carsonite Rod, 5/8"

Burn Site No. 2
Set June 9, 1982
Inspection Date - June 16, 1983

This monument was severly damaged in the fire. All resin had melted away and the rod had broken at ground level. Only frayed glass fibers remained above ground level. Below ground level, the rod was in very good condition.

The cast aluminum-magnesium alloy cap had melted. The cap magnet could be seen and was in very good condition.

No. 9 - Stainless Steel Rod, 5/8", Type 304

Burn Site No. 2
Set June 9, 1982
Inspection Date - June 16, 1983

The stainless steel monument was not damaged by the fire. This rod was found to be in very good condition.

A cap had not been placed on this monument when it was set on June 9, 1982.

Comments Concerning the Burn

According to Mr. Bill Rametes, National Forest Service, Redding District, this prescribed burn was a normal type slash fire. The fuel in this burn area was a mixed conifer logging slash with very little grass or brush. Although temperature measurements were not taken, the fire most likely did not have a uniform temperature. It is believed that some areas of the fire burned at a higher temperature than other areas. So conclusions drawn from this inspection should be tempered with the above knowledge. It should be pointed out, however, that all monuments were set relatively close to each other in one area (approx. 20' x 10'), and the fuel loading in this area was fairly uniform.

The fact is that some aluminum monuments melted while others did not. Forest Service representatives felt that hot spots in the fire may account for this condition. Another fact is that both aluminum pipes survived the fire while the aluminum rod did not. Examining this condition more closely, the pipes have a much larger surface area than the rod has. Since aluminum is an excellent conductor, it could have conducted some of the heat from the hot side of the pipe, leading edge of the fire, to the cooler side, and also conducted heat to the ground and kept the temperature from rising above the melting point for aluminum, approximately 1080° F. The surface area in contact with the ground is much larger for the pipes also.

Another observation made from this inspection was that the cast aluminum-magnesium alloy caps melted more readily than the pure aluminum caps. This could be accounted for by having different temperatures within the fire.

The carsonite, fiberglass, and PVC monuments were either severely damaged or destroyed and are not recommended for use in this type of environment.

The standard iron post type monument and the stainless steel rod were <u>not</u> damaged by the fire.

PART II

Established a New Monument Test Bed in Acid-Type Soils

near Redding, California

June 21, 1983

New Test Site No. 3

Location: N 1/2 of Section 22, T34N, R3W, Shasta County, California
Near Bully Hill Mine Area

Personnel Present:

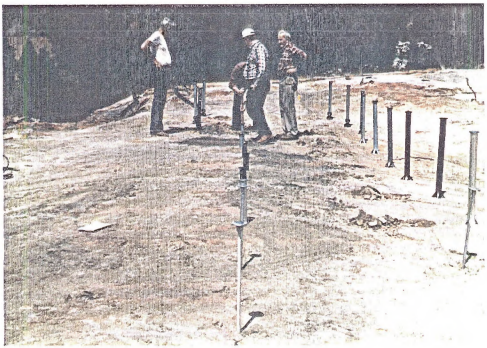
John Brewer
John Hohol
Bob Hofland
Ken Lanspa
Dick Case

Soil Ph: Approximately 3.0

Three soil samples were taken from this site for further analysis:

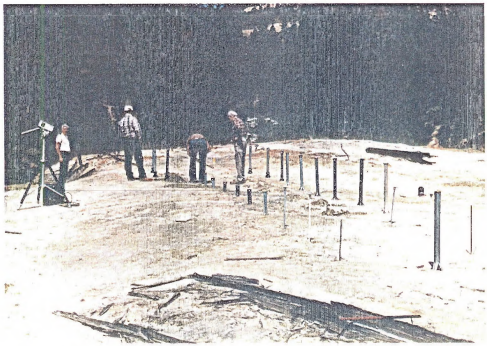
(1) Surface to 12" below ground; yellow in color
(2) 12" to 21" below ground surface; gray in color
(3) 21" below ground surface; brown-red in color

Two lines of monuments were set at Test Site No. 3, Lines No. A and B. Line A monuments will be inspected on an annual basis while Line B monuments (identical types) will only be inspected at three- to five-year intervals.



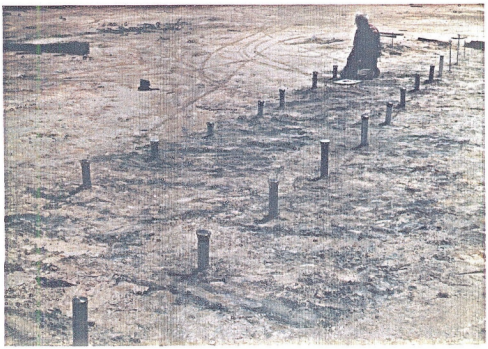
Types of Monuments Set
(All set on June 21, 1983)

	Test Line A	Test Line B
No. 1 - Standard Galvanized Iron Post	1 each	1 each
No. 2 - Stainless Steel Post, Type 304, Schedule 5, A-5	1 each	1 each
No. 3 - PVC, Schedule 80	1 each	1 each
No. 4 - Standard Galvanized Iron Post (Type 120)	1 each	1 each
No. 5 - Standard Galvanized Iron Post (Type A-53)	1 each	1 each
No. 6 - Stainless Steel Post, Type 304, Schedule 5, H	1 each	1 each
No. 7 - Anodized Alumninum Post	1 each	1 each
No. 8 - Epoxy Coated Aluminum	1 each	1 each
No. 9 - Standard Aluminum Post	1 each	1 each
No. 10 - Aluminum 3/4" Rod	1 each	1 each
No. 11 - Fiberglass 3/4" Rod	1 each	1 each
No. 12 - Stainless Steel 5/8" Rod, Type 304	1 each	1 each
No. 13 - National Forest Service Monument, Standard Galvanized Iron Post with Brass Cap (A-120)	1 each	-0-



Installation

Test Site No. 3 Completed



TEST SITE No. 3

	1	2	3	4	5	6	7	8	9	10	11	12
Line B.	B A-4BR Std. Monu.	B A-5 SS 304 Sched-5	B A-3 PVC Sched-80	H 120 Std. Monu.	H A-53 Std. Monu.	H SS 304 Sched-5	A Anodized Al	A Epoxy Coated Al	A Al	B Al 3/4 Rod	B Fiberglass 3/4 Rod	A SS 304 5/8 Rod
Line A.	H A-120 Std. Monu. NFS Sched-90	B Std. Monu.	B SS 304 Sched-5	B PVC Sched-80	H 120 Std. Monu.	H A-53 Std. Monu.	H SS 304 Sched-5	A Anodized Al	A Epoxy Coated Al	A Al	B Al 3/4 Rod	B Fiberglass 3/4 Rod	A SS 304 5/8 Rod

Soil pH Approx. 3.0

Shasta County, California

(Near old copper mine)

A. -- Allied Manufactured
B. -- Berntsen Manufactured
H. -- Hofland Manufactured

Location:
N½ of Sect 22, T 34N, R3W
Shasta County, California

PART III

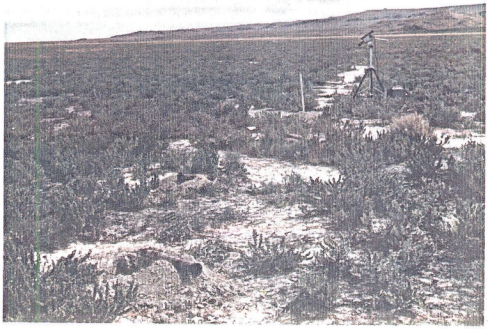
Inspection of Cadastral Survey Monuments Located in Test Sites No. 1A and No. 2 near Salt Lake City, Utah

June 23, 1983

Test Site No. 1A
Soil pH - 8.0
Inspection Date - June 23, 1983

Personnel Present:

John Brewer	John Ferguson
Glen Hatch	Rick Feldman
John Hohol	Dick Case



Galvanized Wrought Iron

Monument Test Set - No. 2
Set in 1962
Inspection Date - June 23, 1983

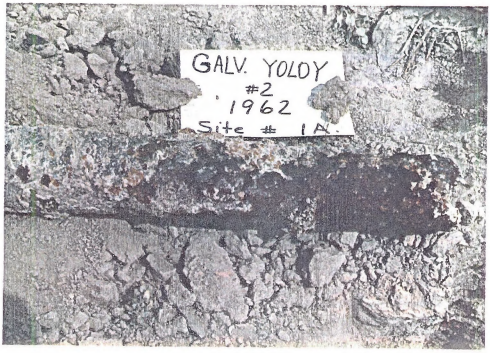
Above ground line, the monument has slight rust but is solid and in good condition.

Below ground level there is severe corrosion, and extensive rust and loss of metal. The corrosion takes the form of parallel etched grooves that run parallel to the pipe length. The lower portion of the pipe is thin with some holes appearing. The flange has corroded away.

This monument is in poor condition.

Galvanzied Yoloy

Monument Test Set - No. 2
Set in 1962
Inspection Date - June 23, 1983



Above ground line the monument has slight rust, but is in good condition.

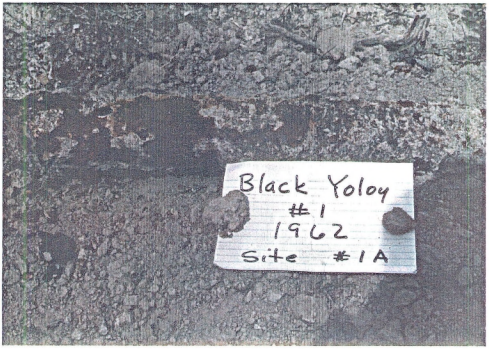
Corrosion begins at the ground line.

Below ground level there is a heavy rust build-up getting worse with depth. The flange and lower inch and one-half to two inches of the pipe have corroded away. The corrosion takes the form of very deep pits and appears red-brown in color.

The lower portion of this pipe is very thin and the monument is in very poor condition.

Black Yoloy

Monument Test Set - No. 2
Set in 1962
Inspection Date - June 23, 1983



Above ground level there is a slight rust but this portion of the monument is very solid.

At the ground line there is a heavy rust build-up with pitting.

Below ground level there is a severe rust build-up with continuous pitting over the entire pipe body. The corrosion gets worse with depth. The flange and lower three to four inches of the pipe have corroded away. The corrosion is in the form of deep pits, appearing red-black in color.

This monument is in very poor condition, with large holes appearing in the lower portion of the remaining pipe.

Galvanized Carbon

Monument Test Set - No. 2
Set in 1962
Inspection Date - June 23, 1983

Above ground level there is no rust and this portion of the monument is in very good condition.

A light rust begins at the ground line, and below ground there is a heavy build-up of rust with severe pitting. Some pits have corroded through the pipe wall. This corrosion is in the form of pits with no uniform pattern. Pitted areas are red-black in color.

This monument is in poor condition.

Black Carbon

Monument Test Set - No. 2
Set in 1962
Inspection Date - June 23, 1983

Above ground level the monument is rusty but in good condition.

At the ground line the rust starts to build up and is associated with small pits.

Below ground line there is a heavy build-up of rust with severe corrosion. There are many large pits over the entire pipe body with several holes appearing in the lower portion of the pipe. The flange and lower four inches of the pipe have completely corroded away.

This monument is in very poor condition.

Fiberglass

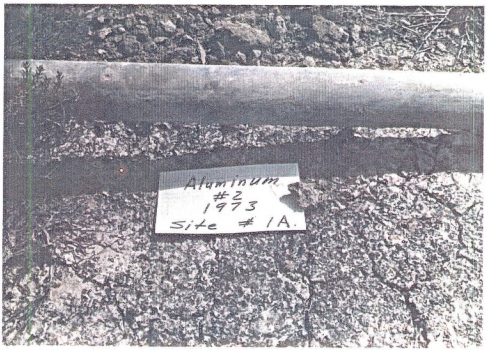
Monument Test Set - No. 2
Set in 1967
Inspection Date - June 23, 1983

Above ground level the glass fibers are beginning to show through the resin. This is probably due to sun exposure.

Below ground line this monument is in excellent condition. The foot pad was broken off during removal.

Aluminum Pipe

Monument Test Set - No. 2
Set in 1973
Inspection Date - June 23, 1983



Above ground level the monument is gray in color, slightly discolored, but in very good coondition.

At the ground line the monument has slight pitting.

Below ground level the monument has some pits over much of the body. Some of the pits are deep, measuring approximately 1/16" deep. The foot pad has a few corrosion spots evidenced by a white crystalline type structure.

Aluminum Pipe

Monument Test Set - No. 2
Set in 1977
Inspection Date - June 23, 1983

Above ground level this monument has a few discolored spots, but is in excellent condition.

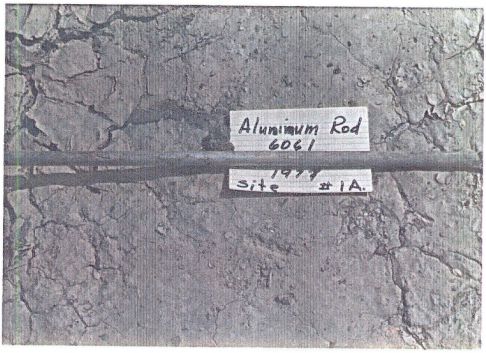
At the ground line there is a slight corrosion over large areas of the pipe.

Below ground level the monument has deeper pits but covering smaller areas than the corrosion at ground line. Some of these pits are approximately 1/16" deep. Many spots on the pipe body are covered by white crystalline particles.

This monument is in good condition.

Aluminum Rod, 5/8", Type 6061

Monument Test Set - No. 2
Set in 1977
Inspection Date - June 23, 1983



Above ground line this monument has several gray discolored spots, but is in excellent condition.

Below ground level there is one area with deep pit type corrosion (approximately .050 inch deep). There are a few other areas with white crystalline particles indicating corrosion.

At the drive point-rod interface, metal has corroded away from the rod. White crystalline particles are present indicating corrosion. The damage at this point is believed to be due to the dissimilar materials (aluminum rod and stainless steel screw).

This monument is in good condition.

Aluminum Rod, 3/4", Type 6063

Monument Test Set - No. 2
Set in 1978
Inspection Date - June 23, 1983

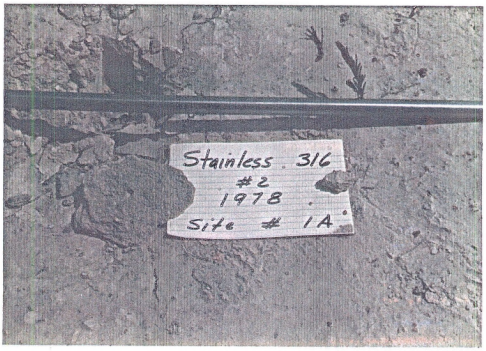
Above ground level the rod is dark in color but in excellent condition.

Below ground level there are several dark spots, but the rod is in very good condition. At the drive point-rod interface, there is a build-up of white crystalline particles indicating corrosion at this point. The corrosion at this point is believed to be due to dissimilar materials (aluminum rod and stainless steel screw).

The monument is in very good condition.

Stainless Steel, 5/8" Rod, Type 316

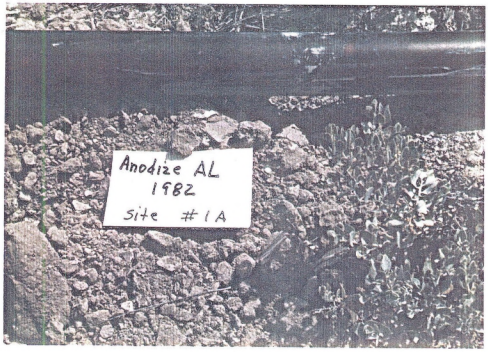
Monument Test Set - No. 2
Set in 1978
Inspection Date - June 23, 1983



This monument is in excellent condition, both above and below ground level. The metal is bright and looks as it did when it was installed.

Anodized Aluminum Post

Monument Test Set - No. 2
Set in 1982
Inspection Date - June 23, 1983



This monument is in excellent condition, both above and below ground level.

Polyvinyl Chloride, PVC Post

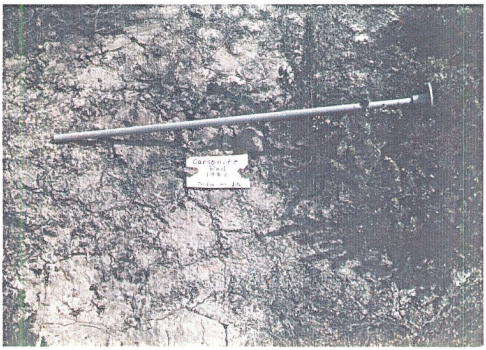
Monument Test Set - No. 2
Set in 1982
Inspection Date - June 23, 1983

This monument is in excellent condition, both above and below ground level.

Note: The flange broke off when the monument was removed for inspection as it was designed to do.

Carsonite Rod, 5/8"

Monument Test Set - No. 2
Set in 1982
Inspection Date - June 23, 1983



This monument is in excellent condition, both above and below ground level. This monument looks as it did when it was first installed.

New Test Bed Monuments

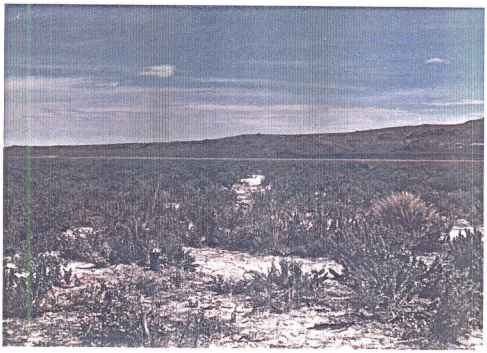
The following new monuments were installed on the northeast end of Line No. 2, Test Site No. 1A:

A. Standard Galvanized Iron Monument, Type A-53, Hofland Contract

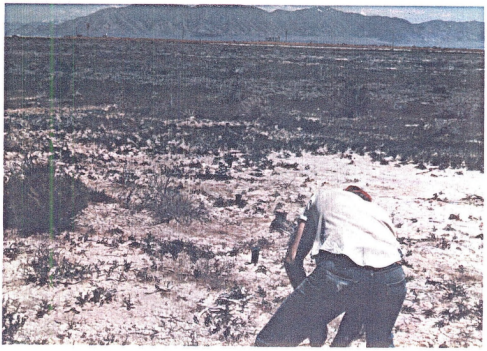
B. Standard Galvanized Iron Monument Type A-120, Hofland Contract

C. Epoxy Aluminum, Allied Contract

D. Stainless Steel Post, Type 304, Schedule No. 5, Berntsen Contract



Test Site No. 2
Soil pH - 7.5
Inspection Date - June 23, 1983



Galvanized Wrought Iron
(1961 Contract)

Monument Test Set - No. 5
Set in 1962
Inspection Date - June 23, 1983

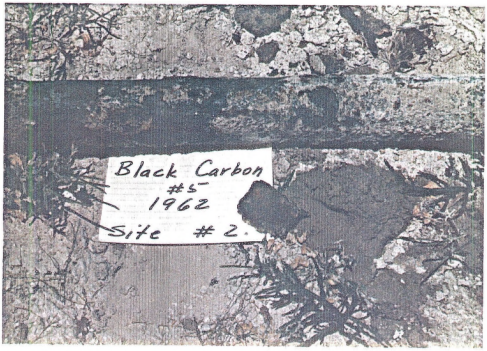
Above ground level the monument has slight rust, but is solid and in good condition.

Below ground level the pipe has a build up of rust and corrosion over the entire pipe. The outermost surface of the pipe is flaking off in several areas. The corrosion appears as parallel grooves that are etched to varying depths.

Note: The galvanizing process seems to lengthen monument life.

Black Carbon

Monument Test Set - No. 5
Set in 1962
Inspection Date - June 23, 1983



Above ground level this monument has a slight rust build-up, but is solid and in good condition.

At the ground line, rust starts to build up.

Below ground level there is a heavy build-up of rust. The outermost portion of the pipe is flaking off in sheets over large areas. The corroded areas are dark gray in color and the flange is very thin.

This monument is in fairly good condition.

Galvanized Carbon

Monument Test Set - No. 5
Set in 1962
Inspection Date - June 23, 1983

Above ground level this monument has a slight build-up of rust, but it is in very good condition.

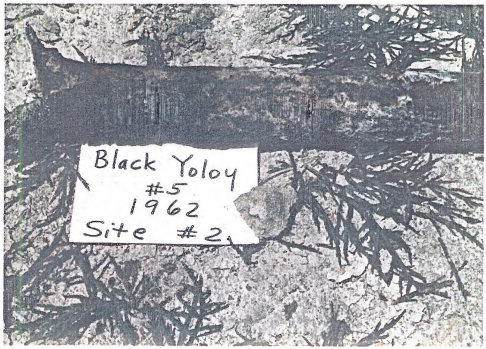
At the ground line there is a build-up of rust.

Below ground level there is a build-up of rust over the entire pipe body with some pitting. Some corroded areas are flaking off and exposing dark gray or black base metal.

This monument is in fairly good condition and again the galvanizing process appears to lengthen monument life.

Black Yoloy

Monument Test Set - No. 5
Set in 1962
Inspection Date - June 23, 1983



Above ground level the monument has a slight rust but is in good condition.

Below ground level the pipe has severe pitting with loss of metal. There are also parallel grooves etched into the pipe. The pitting pattern is irregular and the pipe wall is getting thin. The flange is still attached, but is frayed at the edges and very thin.

This monument is in poor condition.

Galvanized Yoloy

Monument Test Set - No. 5
Set in 1962
Inspection Date - June 23, 1983

Above ground level the monument has slight rust but is in good condition.

Below ground level there is a medium build-up of rust. The corrosion is in the form of slight pitting. The flange is still in fair to good condition.

This monument is still in good condition. The galvanizing process seems to have lengthened this monument's life.

Galvanized Wrought Iron

Monument Test Set - No. 5
Set in 1962
Inspection Date - June 23, 1983

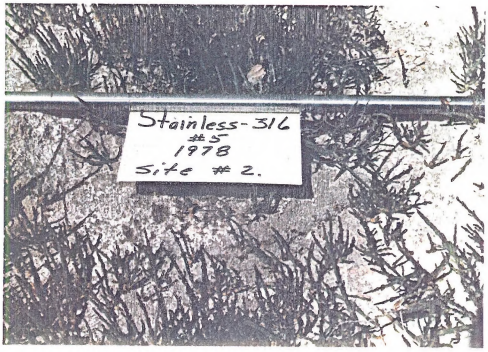
Above ground level the monument has light rust, but is in very good condition.

Below ground level there is a build-up of rust over the entire pipe body. Corrosion takes the form of pits and parallel grooves. The flange is still attached.

This monument is in fairly good condition.

Stainless Steel, Type 316

Monument Test Set - No. 5
Set in 1978
Inspection Date - June 23, 1983



Above ground level the monument is in excellent condition.

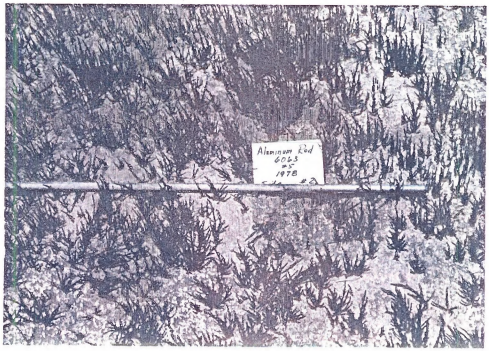
Below ground level the monument had one small discolored spot. The rod body was bright and in excellent condition.

At the ground line there appears to be slight corrosion. There are small grooves around the entire rod that measure only a few thousandths of an inch deep.

This monument is in excellent condition.

Aluminum Rod, 3/4", Type 6063

Monument Test Set - No. 5
Set in 1978
Inspection Date - June 23, 1983



Above ground level the monument has a few dark spots, but it is in very good condition.

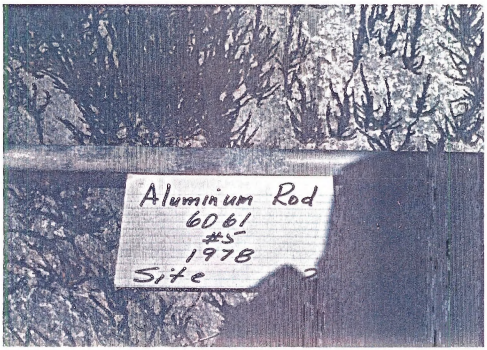
At the ground level there is severe corrosion in the form of pitting covering the entire circumference of the rod. The pitted band width is approximately 2 inches and the grooved depth of pits varies to a maximum depth of approximately 1/8 inch.

Below ground level there appears to be corrosion at the drive point-rod interface. White crystalline particles are present in this area.

This monument is in good condition except at the ground line.

Aluminum Rod, 5/8", Type 6061

Monument Test Set - No. 5
Set in 1978
Inspection Date - June 23, 1983



Above ground level the monument has a few dark spots, but it is in very good condition.

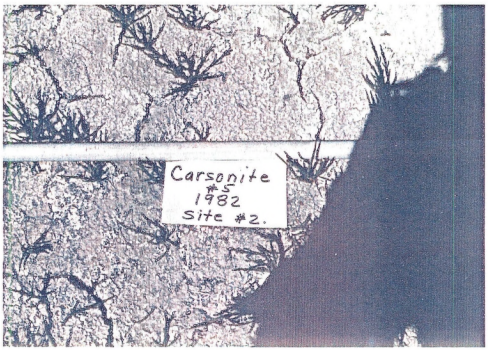
At the ground level there is severe pitting type corrosion covering the entire circumference of the rod. The pitted band width is approximately 1" wide and the depth of corrosion varies from approximately 1/32" to 1/16" deep.

Below ground level there appears to be corrosion at the drive point-rod interface. White crystalline particles are present in this area.

This monument is in good condition except for the area at the ground line.

Carsonite Rod, 5/8"

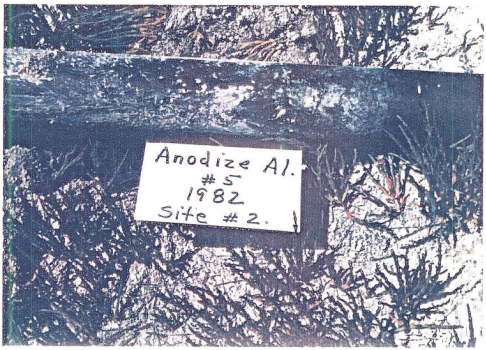
Monument Test Set - No. 5
Set in 1982
Inspection Date - June 23, 1983



This monument is in excellent condition above ground, below ground, and at the ground line.

Anodized Aluminum Post

Monument Test Set - No. 5
Set in 1982
Inspection Date - June 23, 1983



This monument is in excellent condition above ground, below ground, and at the ground line.

Polyvinyl Chloride, PVC, Post

Monument Test Set - No. 5
Set in 1982
Inspection Date - June 23, 1983

This monument is in excellent condition above ground, below ground, and at the ground line.

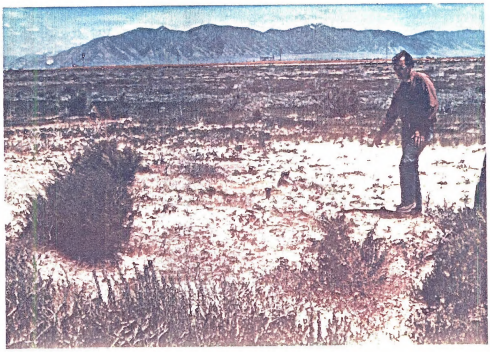
New Test Bed Monuments

The following new monuments were installed on the southeast end of Test Site No. 2:

A. Standard Galvanized Iron Monument, Type A-53, Hofland Contract

B. Standard Galvanized Iron Monument, Type A-120, Hofland Contract

C. Epoxy Aluminum, Allied Contract



Oxbow Burn Area

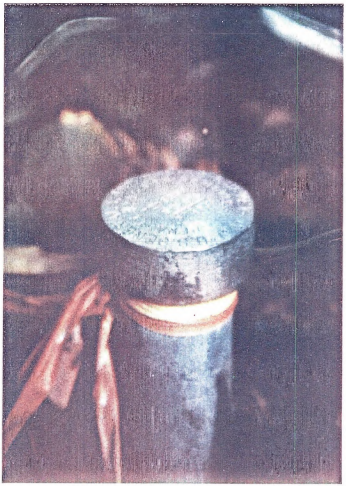
Location: Eugene, Oregon District

Personnel Present: John Brewer
Les Fischer
Bob Hofland
John Hohol
Leonard Murphy

An inspection was made of the Oxbow burn area near Eugene, Oregon, to determine the condition of some of the monuments that has survived the 1967 fire that had burned through that area.

Standard Galvanized Iron Post

Oxbow Burn Site
Set in 1950
Inspection Date - June 13, 1983



The monuments that were inspected were set in 1950. There was evidence of scorching on the brass cap and pipe above ground. The inscription on the cap was totally legible and the galvanizing, though discolored, was still intact on the pipe.

At a depth of about 12" below ground there was an area of light surface rust on the pipe.

There was no significant deterioration as a result of 33 years in the soil, or from the fire that took place 16 years ago.

Fiberglass Monument

Eugene District (outside burned area)
Set in 1966
Inspection Date - June 13, 1983

There was no weathering or apparent deterioration of this monument. (Note: The light marks on the side of the fiberglass pipe are as a result of intentionally scraping it.)

This monument was set in an area of heavy underbrush along the edge of a farm pasture. Undoubtedly the shade and protection provided by the underbrush has some bearing on the excellent condition of this monument.

Having been in the ground some 17 years, this monument was in as good condition as the day it was set.

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